Programme Name/s : **Automobile Engineering.**
Programme Code : **AE**
Semester : **Third**
Course Title : **FUNDAMENTALS OF AUTOMOBILE ENGINES**
Course Code : **313312**

I. RATIONALE

Internal combustion (IC) engines find extensive application in a various range of vehicles, including cars, motorcycles, trucks, and airplanes, as well as in industrial and power generation contexts. This course is designed to cultivate proficiency in identifying and locating engine parts, understanding their functions, managing minor settings, and executing the procedures for the disassembly and assembly of systems and components related to automobile engines. Successful completion of this course is a prerequisite for advancing into more advanced engine technology studies.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Check the functioning of engine components in both two-wheeler and passenger car.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Interpret the given engine specifications.
- CO2 - Identify engine components and their respective locations.
- CO3 - Perform minor adjustments to the fuel feed system
- CO4 - Inspect the ignition system to ensure proper functioning
- CO5 - Maintain cooling and lubrication systems of the vehicle.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical							
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
313312	FUNDAMENTALS OF AUTOMOBILE ENGINES	FAE	DSC	4	-	2	2	8	4	3	30	70	100	40	25	10	25@	10	25	10	175

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 State the advantages and disadvantages of the IC engines TLO 1.2 Describe valve timing diagram for SI and CI Engines TLO 1.3 Define engine terminology TLO 1.4 Describe working principle of given engine TLO 1.5 Differentiate between SI and CI engines on the basis of given parameters TLO 1.6 Compare engine working cycles on the basis of given parameters.	**Unit - I Basics of Automobile Engines** 1.1 Basic engine terminology- Cylinder bore, Stroke, TDC, BDC, Clearance volume, swept volume, Total volume, Cubic Capacity, Compression ratio, Power and Torque. Classification of I.C. Engines. Engine specifications, Limitation and Applications of IC engines. 1.2 Cycle of operations in four strokes and two-stroke SI and CI engines, valve timing diagrams & their comparative study; Scavenging. 1.3 Air standard and Fuel air cycles, Actual cycles, Deviation of actual engine cycle from ideal cycle 1.4 Comparison of otto, diesel and dual cycle.	Chalk Board/ White Board Presentations Model demonstration Video demonstration

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 List the different components of the given automobile engine TLO 2.2 Describe constructional features of the given engine components TLO 2.3 Sketch the valve arrangement used in the automobile engine. TLO 2.4 Describe functions of the given engine components. TLO 2.5 Suggest suitable material for given component with relevant justification	**Unit - II Constructional Features of Engine Components** 2.1 Engine subsystems and components-location, functions, specific features and materials- Cylinder block, Cylinder liner, Cylinder head, Gaskets, Piston, Piston rings, Piston pin, Crank shaft, Camshaft, Connecting rod, Oil sump. 2.2 Valves and Valve operating mechanisms- types, valve material, Valve springs, Valve guides, Cam and followers. Push rods, rocker arm. OHV and OHC system, Valve cooling 2.3 Camshaft drives: Timing Gears, Chain and Belt drive.	Model Demonstration Presentations Demonstration Presentations
3	TLO 3.1 Describe construction and working of the given type of carburetion system with sketches. TLO 3.2 Explain with sketches the construction and working of the given type of fuel injection system. TLO 3.3 Describe with sketch the working of mechanical governor TLO 3.4 List different types of nozzles used in diesel fuel injection system.	**Unit - III Fuel and Air feed system** 3.1 Petrol fuel supply system- Types, Layout, location and functions of components, Fuel Tank, Fuel Filter, S. U. Electrical Fuel Pump. 3.2 Principle of carburetion, Air fuel ratio requirements, Simple carburetor, limitations of simple carburetor, Types of carburetors (Carter, Solex & SU) 3.3 Need and requirements of Fuel Injection Systems; layout and types-Individual pump, Unit injector system, Distributor system and Common rail system. 3.4 Fuel Injector and types of nozzles. Fuel metering in Fuel Injection Pump (Inline pump and Distributor pump) 3.5 Working of Mechanical Governor in Fuel Injection Pump. 3.6 Air cleaners and Filters.	Demonstration Model Demonstration Video Demonstrations Presentations
4	TLO 4.1 Explain with sketch the working of the given type of ignition system. TLO 4.2 Explain the firing order of the given engine with relevant justification TLO 4.3 Explain with sketch the construction and working of exhaust system TLO 4.4 Select the relevant type of silencer/Mufflers for the given engine.	**Unit - IV Ignition and Exhaust System** 4.1 Requirements of ignition system 4.2 Magneto and Battery Ignition system-layout, construction and working 4.3 Engine firing order-Necessity, Firing order of 3,4 and 6 cylinder engines 4.4 Function of Exhaust manifold. 4.5 Types of silencer / Mufflers (Construction and Working).	Model Demonstration Video Demonstrations Presentations Demonstration

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
5	TLO 5.1 Describe the need and functions of cooling system TLO 5.2 Describe the need and functions of lubrication system TLO 5.3 Explain with the sketch construction and working of the cooling system. TLO 5.4 Describe various properties of coolant and their effects on cooling performance TLO 5.5 Describe properties of the given type of engine oil and their effects TLO 5.6 Select the relevant coolant and engine oil for given operating condition.	**Unit - V Engine Cooling and Lubrication system** 5.1 Need of cooling system and limitations of cooling system. 5.2 Types: Air, Water/ Liquid cooling system (Layout and Function of Components) 5.3 Engine Coolants and additives-Types and Characteristics and their effect on performance of engine cooling 5.4 Cooling system components- Construction and working of Thermostat valve, Water expansion tank, Temperature Indicators, Pressure cap, Water pump, Fan and fan belt, electrically driven Fan circuit. 5.5 Radiator: Construction and type of radiator cores 5.6 Need, Properties and additives used in lubricating oil, Parts to be lubricated 5.7 Classification of Lubricating Oils on the basis of Viscosity (SAE) and Load (API) Severity rating; Types of lubrication system-Mist, Splash, Pressure – wet sump and dry sump 5.8 Functions of Components: Oil filters, Oil pump and its drive, pressure regulators, oil pressure gauge.	Model Demonstration Video Demonstrations Presentations Demonstration

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Observe different engine Components /sub assembly LLO 1.2 Identify location of various engine subassemblies/ components of given engine and their interconnectivity	1	*Identify the components in the given cut section/working models of 2/4 stroke engines (petrol/ diesel)	2	CO1
LLO 2.1 Use suitable tools to dismantle the engine as per service manual LLO 2.2 Identify major components LLO 2.3 Follow safety precautions for dismantling the engine	2	*Dismantle two/four-wheeler engine	2	CO2
LLO 3.1 Identify the different components of a given engine LLO 3.2 Enlist the specification and function of each component of the given engine with sketches LLO 3.3 Prepare a report on the following aspects: Constructional details, materials and manufacturing process, Working principles and operation of components	3	Examine the major engine components (Minimum Five)	2	CO2

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 4.1 Measure dimensional parameters of Engine components (eg. crank throw in crankshaft, dimeters of main journal and crankpin journals) LLO 4.2 Record the dimensions of each component and compare with the service/ workshop manual LLO 4.3 Prepare report with relevant data and sketches	4	*Measure dimensional parameters of Engine components (Eg. crank throw in crankshaft, dimeters of main journal and crankpin journals)	2	CO2
LLO 5.1 Use suitable tools for checking the valve and valve guide LLO 5.2 Replace the valve if necessary LLO 5.3 Check valve seats leakage LLO 5.4 Dismantle rocker shaft assembly LLO 5.5 Clean and check rocker shaft and levers for wear and cracks and reassemble	5	Inspection of valve seats and valve guide	2	CO2
LLO 6.1 Use suitable tools for dismantling cylinder head assembly LLO 6.2 Check the flatness of the cylinder head with a feeler Gauge LLO 6.3 Reassemble removable parts in sequence LLO 6.4 Refit cylinder head and manifold and other assembly	6	Examine the cylinder head assembly	2	CO2
LLO 7.1 Use appropriate tools for dismantling the carburetor from two-wheeler/ four-wheeler engine. LLO 7.2 Follow standard procedure / service manual to check the different components LLO 7.3 Reassemble it accurately.	7	*Carburetor Dismantling and Refitting (Two-Wheeler/Four-Wheeler)	2	CO3
LLO 8.1 Dismantle the reciprocating /rotary plunger type fuel injection pump as per service manual LLO 8.2 Identify and check various components LLO 8.3 Reassemble the rotary plunger type fuel injection pump accurately	8	Fuel Injection Pump	2	CO3
LLO 9.1 Identify the different components of the fuel supply systems LLO 9.2 Describe the function of each component of the given system with sketches LLO 9.3 Prepare report with referring to workshop manual process	9	*Diesel fuel injection system	2	CO3
LLO 10.1 Check the given fuel filter LLO 10.2 Replace the faulty fuel filter in an engine LLO 10.3 Use proper techniques for handling and installing fuel filters in both two-wheelers and four-wheelers.	10	Replacement of Fuel Filter (Two-wheelers / four-wheelers)	2	CO3

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 11.1 Identify the different ignition components including spark plugs, ignition coils, and High-Tension (HT) cords. LLO 11.2 Describe the function of each component of Ignition system with sketches LLO 11.3 Perform cleaning, inspection of critical ignition components as per service manual	11	*Maintenance of Spark Plug, Ignition Coil, and HT Cords	2	CO4
LLO 12.1 Identify the suitable grade of engine oil LLO 12.2 Unscrew the drain plug for removing the used oil LLO 12.3 Plug in screw and Refill the engine oil up to the desired level LLO 12.4 Check the oil level and any leakages	12	Practice on change of Engine oil	2	CO5
LLO 13.1 Recognize the role of oil pump, oil filter, and pressure relief valve in engine protection LLO 13.2 Dismantle the given oil pump, oil filter, and pressure relief valve LLO 13.3 Reassemble the components after thoroughly checked	13	*Dismantling and Assembly of Oil Pump, Oil Filter, and Pressure Relief Valve	2	CO5
LLO 14.1 Check proper functioning of different parts such as radiator, radiator fan, Thermostat, water pump etc. LLO 14.2 Check the engine oil pressure, coolant level, radiator cap etc.	14	*Service engine cooling system its parts and check functionality	2	CO5
LLO 15.1 Select suitable coolant LLO 15.2 Follow service manual procedure to drain and refill the coolant LLO 15.3 Check for any leakage from coolant hosepipe	15	Practice on Checking and Top up coolant	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Comparison of Engines: - Collect data on three engines of the same category and compare them based on various parameters such as performance, fuel efficiency, and emissions.
- Ignition System Model: - Develop a working model of a battery ignition system, showcasing its components and the ignition process.
- Coolant and Lubricant Market Report: - Collect data on available coolants and lubricants in the market, preparing a comprehensive report on their specifications, applications, and market trends.

- Cut-Section Model of Cooling System Component: - Prepare a cut-section model of a used cooling system component or assembly, visually demonstrating its internal structure and functioning.
- Engine Components Comparison: - Collect engine components from various engines and compare them on aspects like material, design, and functionality.
- Cut-Section Model of Lubrication System Component: - Create a cut-section model of a used lubrication system component or assembly, highlighting its internal mechanisms and the flow of lubricants.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	General purpose tools (Spanners, ring spanner and socket)- 6mm to 32 mm	11
2	Engine dismantling and assembly tools	12
3	Fuel Supply system (Petrol)- including carburettor, fuel pump and fuel filter of two wheeler/ four wheeler	2
4	Four stroke engine cut-section model- single cylinder (motorized/ manual)	2
5	Two stroke engine cut-section model- single cylinder (motorized/ manual)	2
6	Fuel Supply system (Diesel) - Fuel Injection pump, primary filter, secondary filter, Injectors. - Single cylinder/ multi-cylinder engine FIP unit.	4
7	Distributor, ignition system demonstration model	4
8	Four stroke multi-cylinder diesel/ petrol engine with water cooling system	5
9	Special purpose tools (Piston ring expander, Piston ring compressor, Valve lifter, Torque wrench)- Torque wrench range- 10 Nm to 200Nm.	8
10	Four stroke diesel / petrol engine with lubrication system	8
11	Consumables (cotton waste, fuel and lubricants), Water supply provision, Electrical supply provision, Exhaust gas outlet, Wooden blocks, safety equipment, fire extinguisher	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Basics of Automobile Engines	CO1	10	4	6	4	14
2	II	Constructional Features of Engine Components	CO2	16	2	8	6	16
3	III	Fuel and Air feed system	CO3	16	2	8	6	16
4	IV	Ignition and Exhaust System	CO4	8	4	2	4	10
5	V	Engine Cooling and Lubrication system	CO5	10	2	8	4	14

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
Grand Total				60	14	32	24	70

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Tests Seminar/Presentation Term Work

Summative Assessment (Assessment of Learning)

- Practical Theory

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	-	-	3	2	-	3			
CO2	3	-	-	3	2	-	3			
CO3	3	-	-	3	2	3	3			
CO4	3	3	3	3	2	-	3			
CO5	3	3	3	3	2	-	3			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	V. A. W Hiller	Hiller's Fundamentals of Motor Vehicle Technology -Book 1	Nelson Thrones Ltd UK Sixth Edition 16/10987654321
2	H N Gupta	Fundamentals of Internal Combustion Engines 2nd Edition	Prentice Hall India ISBN 978-8120346802
3	Jain and Asthana	Automobile Engineering	McGraw Hill Education ISBN 978-0070445291
4	M.L.Mathur and S.C.Sharma	Internal Combustion Engines	Dhanpat rai Publications ISBN 978-9383182428
5	V. Ganesan	Internal Combustion Engines	McGraw Hill Education ISBN 978-1259006197

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=bZUoLo5t7kg	Petrol (Gasoline) Engine vs Diesel Engine
2	https://www.youtube.com/watch?v=BXQ27pU3_7E	Assembly of four stroke engines
3	https://www.youtube.com/watch?v=ASSsg8hcQjM	Engine: structure and name of parts / Gradual engine disassembly in 3D animation
4	https://www.youtube.com/watch?v=0VDIV-A-Y7A	Carburetor working visualization
5	https://www.youtube.com/watch?v=TqQE0xkCJ8c	Ignition system working
6	https://www.youtube.com/watch?v=g7LNA4w6wOI	Silencer working
7	https://www.youtube.com/watch?v=vRZu3-64yo0	Cooling system
8	https://www.youtube.com/watch?v=9lse1SfDq7M	Lubrication system

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students